RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

Resilient Synchronized Planning and Assessment for the Contested Environment (RSPACE)
DARPA-BAA-15-08

Proposer's Day

January 5, 2015

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

Resilient Synchronized Planning and Assessment for the Contested Environment (RSPACE)

Mark Doody
Program Security Officer
703-248-2687

Stanley R. Smith
Program Security Representative
(703) 526-1719
stanley.smith.ctr@darpa.mil

05 Jan 2015

Overview

- RSPACE Security Team
- Security Overview
- Public Release
- Emergency Procedures

This meeting is UNCLASSIFIED.

- Please leave all electronic devices in the lobby.

Electronic Devices

- All electronic devices (two way pagers, cell phones, cameras, recording devices, laptop computers, etc.) are prohibited.
- These must be left with the technical office representative during registration, in the containers or checked-in with the Visitor Control Center.
- Use of recording devices is prohibited at all times.
- Access to any DARPA wired internet connections is prohibited without explicit permission from the DARPA/STO PSO

DARPA Conference Center Badges

- DCC white badges will grant you access to the authorized first floor areas ONLY (breakout conference rooms, lobby areas, café, restrooms).
- DCC badges must be clearly displayed at all times.
- If leaving the building during breaks, please conceal your DCC badges. If done for the day, please return DCC badge to registration staff member.

RSPACE Security Team

- Program Manager (PM)
  - Dr. Craig Lawrence – (703) 526-2008 – craig.lawrence@darpa.mil
    - Overall program oversight

- Program Security Officer (PSO)
  - Mr. Mark Doody– (703) 526-2687 – mark.doody@darpa.mil
    - Responsible for program protection for Strategic Technology Office (STO) information; reports directly to DARPA/SAPCO

- Program Security Representative (PSR)
  - Mr. Stanley R. Smith – (703) 526-1719 – stanley.smith.ctr@darpa.mil
    - Day to day security liaison for testing and program security concerns

- Defense Security Service (DSS)
  - Local Field Representative – contact your FSO

Emergency Lockdown Procedures

- Remain calm, do not panic.
- If we are in the conference room remain here.
- If we are on break, proceed to the nearest closable room (e.g. office, bathroom, conference room) and assist others who need help. Once in the room, immediately shut, lock and barricade the door.
- Turn cell phones to vibrate.
- Remain quiet and out of sight. Stay away from the door.
- If you see the shooter or hear gunfire, take action immediately! Run, hide or at the last resort, fight.
- Do not peek out of your room – wait for the police.
- Stay in the locked room and wait for further instructions or until the “all clear” notification is announced.

Questions

Are there any questions?

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

Resilient Synchronized Planning and Assessment for the Contested Environment (RSPACE)
DARPA-BAA-15-08

Proposer's Day

January 5, 2015

Craig Lawrence, PM

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

DARPA Strategic Technology Office
Contested Environment Strategy and Plans

Dr. Nils Sandell

Director, Strategic Technology Office

January 5, 2015

Strategic Technology Office (STO) Focus: Advanced Mission Systems

- **Battle Management, Command and Control (BMC2) Algorithms**
  - Distributed Systems
- Communications and Networking
  - Optical
  - Millimeter Wave
  - Mobile Ad Hoc Networks
- Electronic Warfare
- Position, Navigation and Timing
  - Cold Atom Inertial Measurement Units and Clocks
- Sensors
  - Radar
  - Lasers
  - EO/IR
  - Sonar
  - Sensor Processing and Exploitation
- System of Systems Integration Technology

STO is Addressing Key National Defense Challenges

- Diverse threat
  - Terrorism
  - Rogue nations
  - Peer competitors
- High-end threat increasing in quality
  - Electronics drawn from commercial technology base
  - Proliferating widely
- U.S. platforms taking too long to field
  - Commercial components obsolete even before fielding
  - Outpaced by threat
- Cannot afford to buy platforms in needed quantities
  - F-22 : 750 -> 648 -> 438 ->277 -> 188
- Homogeneous fleet
  - Potentially vulnerable to common failure/attack modes
- Integration of new capability slow and costly
  - E.g., challenges integrating with Operational Flight Program (OFP)
- Diminishing industrial base
  - Limited number of do-or-die competitions

New Technologies and Processes Provide Opportunities to Reverse Unfavorable Trends

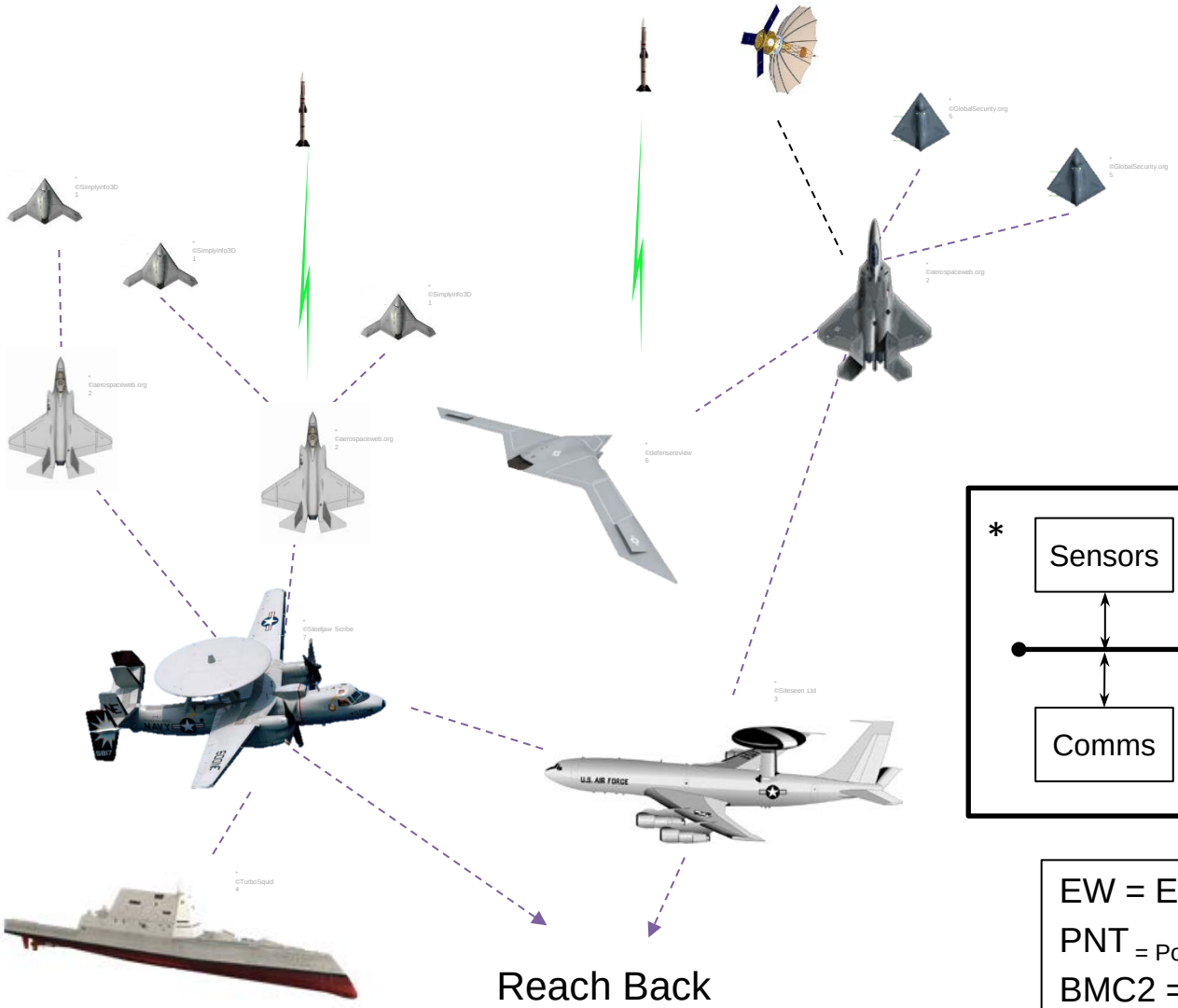
- Technologies
  - Miniaturization, increasing capability and decreasing cost of electronics
  - Expanding spectrum use for communications, electronic warfare, sensing, navigation
  - Advances in algorithm and software technology
  - Unmanned systems and robotics
  - Innovative platforms utilizing advanced materials
- Processes
  - Schedule and cost not requirements-driven programs
  - Open architectures
  - Commercial processes, e.g., “platforming” as a means of cost sharing across products
  - “Payloads over Platforms” (Admiral Greenert)

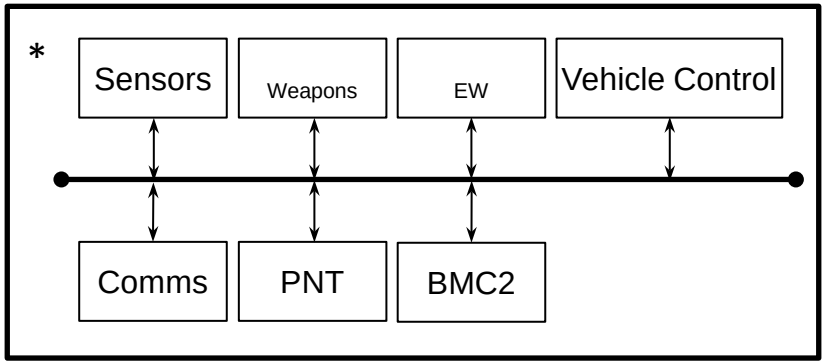
Widespread desire for better ways of developing, acquiring and operating systems

System-of-Systems Approach Exploits Opportunities to Address National Security Challenges

- SoS Approach: Employ architectures mixing lower cost, lower capability platforms with higher cost, higher capability platforms
  - Imposes cost and complexity on adversaries
  - Lower-cost platforms enhance military effectiveness and survivability of higher-cost platforms
  - Heterogeneity minimizes common failure modes/attack vulnerabilities
  - Can buy lower cost SoS elements in quantity
  - Advanced integration technologies and open architectures reduce time, cost, and risk for integration of new capability into legacy platforms
  - Faster development time for new capability and opportunities across a more diversified industrial base

System-of-Systems (SoS): Platforms, Sensors, Weapons, Mission Systems





EW = Electronic Warfare
PNT = Positioning, Navigation and Timing
BMC2 = Battle Management, Command and Control

Contested Environment Challenges and Opportunities – BMC2

- BMC2 Challenges
  - Minimize operator staffing and work-load required to operate as a System of Systems
  - Integrated strike, communications, ISR and EW planning and real-time control for piloted/unmanned, air/surface/subsurface platforms
  - Rapid response to pursue ephemeral engagement opportunities
  - Mission- and not just vehicle-level autonomy
  - Robustness to limited communications and platform attrition
  - Development of user-appropriate technology
- BMC2 Opportunities
  - Adaptable software incorporating distributed algorithms and protocols
  - Situation-specific adaptive autonomy with human-in-the-loop for planning and human-on-the-loop for weapons release authorization during real-time execution
  - Composable validation and verification (V&V) technology to promote operational acceptance and trust of autonomy
  - Coevolution of Concept of Operations (CONOPS) and technology

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

Operational Level Battle Management Processes and Opportunities

Col Richard S. "Scotty" Wright
Commander, 713th Combat Operations Squadron

This Briefing is:
UNCLASSIFIED

To receive the Air Force C2 of Air Operations slides presented at Proposer's Day, please send a request to

the BAA mailbox: DARPA-BAA-15-08@darpa.mil.

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

Headquarters Air Combat Command

Distributed Control Concept
Resilient C2
ACC Support to PACAF

Jeff “Rock” York, Col (s), USAF
ACC/A5C

This Briefing is:
UNCLASSIFIED

To receive the Air Force Distributed Control slides presented at Proposer's Day, please send a request to

the BAA mailbox: DARPA-BAA-15-08@darpa.mil.

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

Resilient Synchronized Planning and Assessment for the Contested Environment (RSPACE)

Dr. Craig Lawrence, STO Program Manager

Proposer's Day Presentation
January 5, 2015

NOTE: This presentation was slightly modified from what was presented on 5 January for consistency with the posted BAA

Program Objectives

RSPACE: Resilient Synchronized Planning and Assessment for the Contested Environment

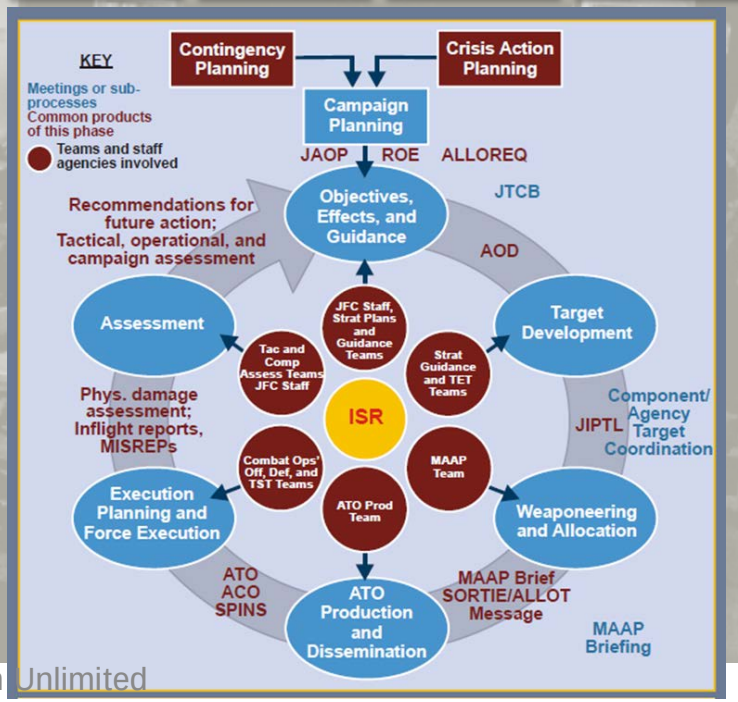
- **Context**: Peer threat is driving a system-of-systems-based approach incorporating innovative technologies into future airborne architectures, e.g.,
  - Highly capable multi-role platforms combined with low-cost specialized platforms
  - Manned-unmanned teams and autonomy
  - Disaggregated capabilities (e.g., distributed EW, multi-static radar)
- **Challenge**: Highly contested environment threatens todays operations centers, limits or denies the use of space, degrades communications, and renders many traditional tactics irrelevant
- **Program Objective**: Operational-level command and control (C2) of current and future architectures ensuring continuity and maximizing effectiveness of air operations in a peer-threat contested environment
  - *Command and Control* - The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission (JP 1-02)

Robust C2 architectures and decision aids to maximize air campaign planners' ability to collaboratively coordinate plans consistent with commander's intent

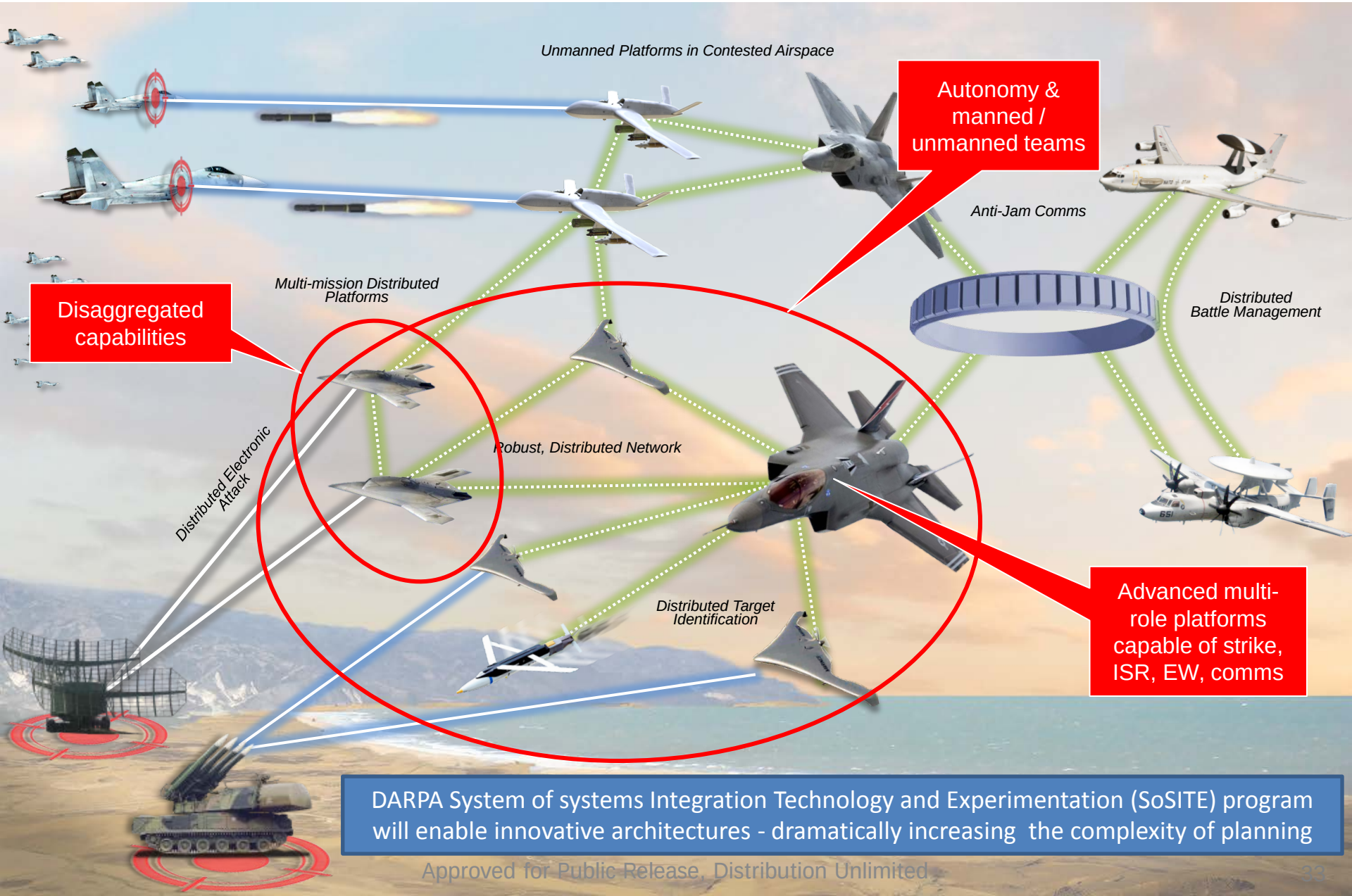
Command and Control of Air Campaigns Currently Occurs at the Air Operations Center (AOC)

- AOC far from the fight (e.g., 613th at Hickam)
- Plan generation process is highly centralized
  - Operational-level C2 exclusively an AOC function
- Reliant on robust communications and high bandwidth
  - Plan dissemination, coordination, and intel for assessment
- "Stove-piped" planning processes
  - Lacks tight synchronization across domains and echelons
- Process is highly complex and largely manual
  - 72-hour planning cycle requires ~1000 AOC staff to generate 1000s of sorties per day)
- Process emphasizes known fixed targets
  - Dynamic targeting process highly centralized and unlikely to scale

Strategy Division	***Combat Plans Division***	***Combat Operations Division***	***ISR Division***	***Air Mobility Division***
Strategy Plans Team	Targeting Effects Team	Offensive Operations Team	Analysis, Correlation & Fusion Team	Airlift Control Team
Strategy Guidance Team	MAAP Team	Defensive Operations Team	Targets / Combat Assessment Team	Air Refueling Control Team
Operational Assessment Team	ATO Production Team	SODO Team	ISR Operations Team	Air Mobility Control Team
		Interface Control Team	PED Mgmt Team	Medical Evacuation Control Team



Implications of Multi-Role Platforms and Systems of Systems



DARPA System of systems Integration Technology and Experimentation (SoSITE) program will enable innovative architectures - dramatically increasing the complexity of planning

Implications of the Peer Threat

Loss of SATCOM disrupts plan dissemination and status / intel feedback

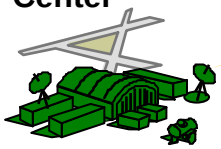
Airborne Battle Manager

Disruption of tactical data links further reduces ability to do assessment

Air Operations Center

Attack on AOC disrupts all planning and assessment

Wing Operations Center



Carrier Strike Group

Tactical Data Link

Stand-Off ISR Platforms

Traditional ISR pushed back, creating a new requirement to plan and control non-traditional ISR

F16

F18

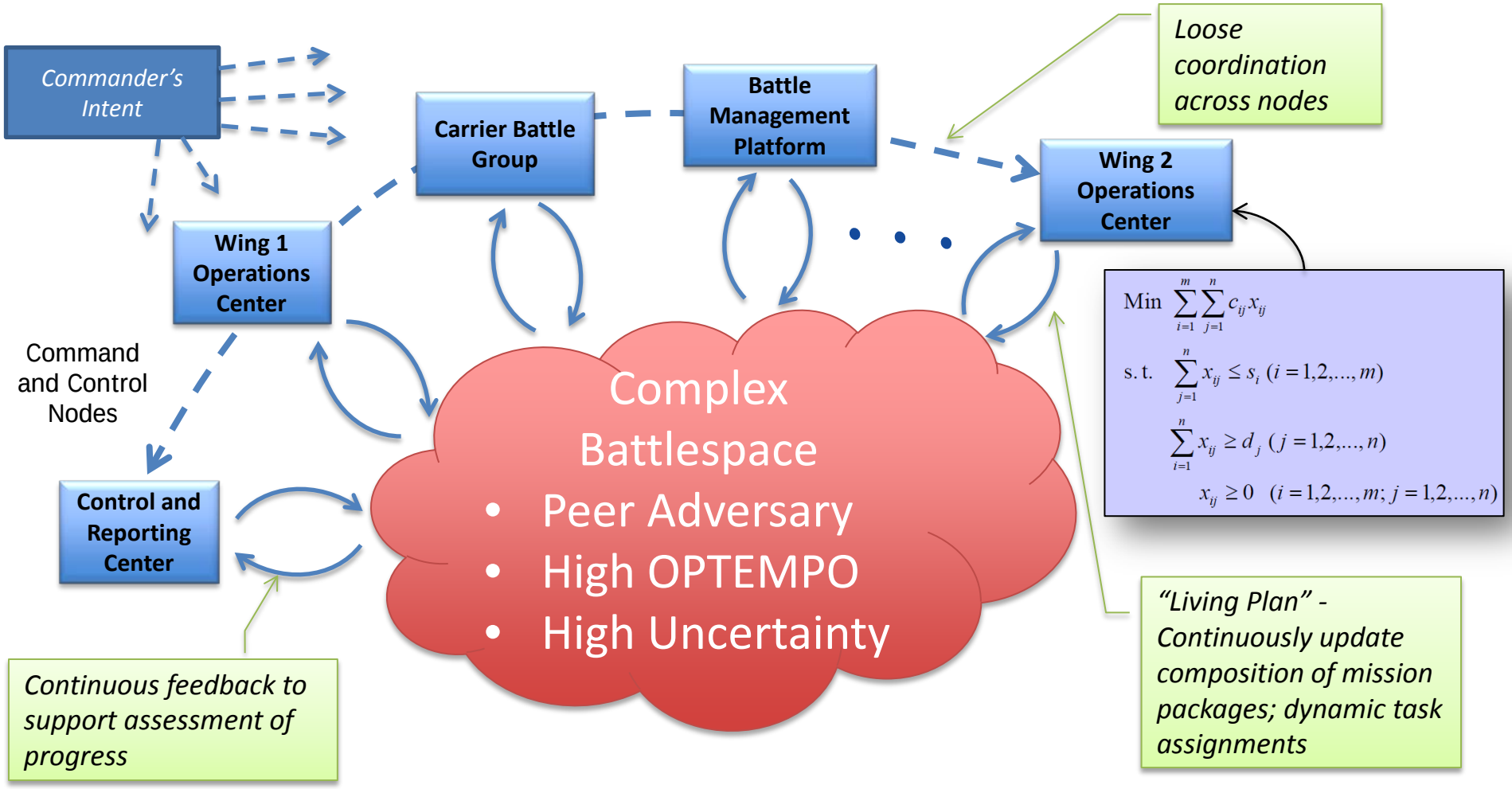
F22

Adversary mobility and deception increases need for dynamic targeting

Severe degradation and potential disruption of operational-level C2 – loss of initiative in the air campaign

RSPACE Vision – Empowering Operators for Real-Time Distributed Planning

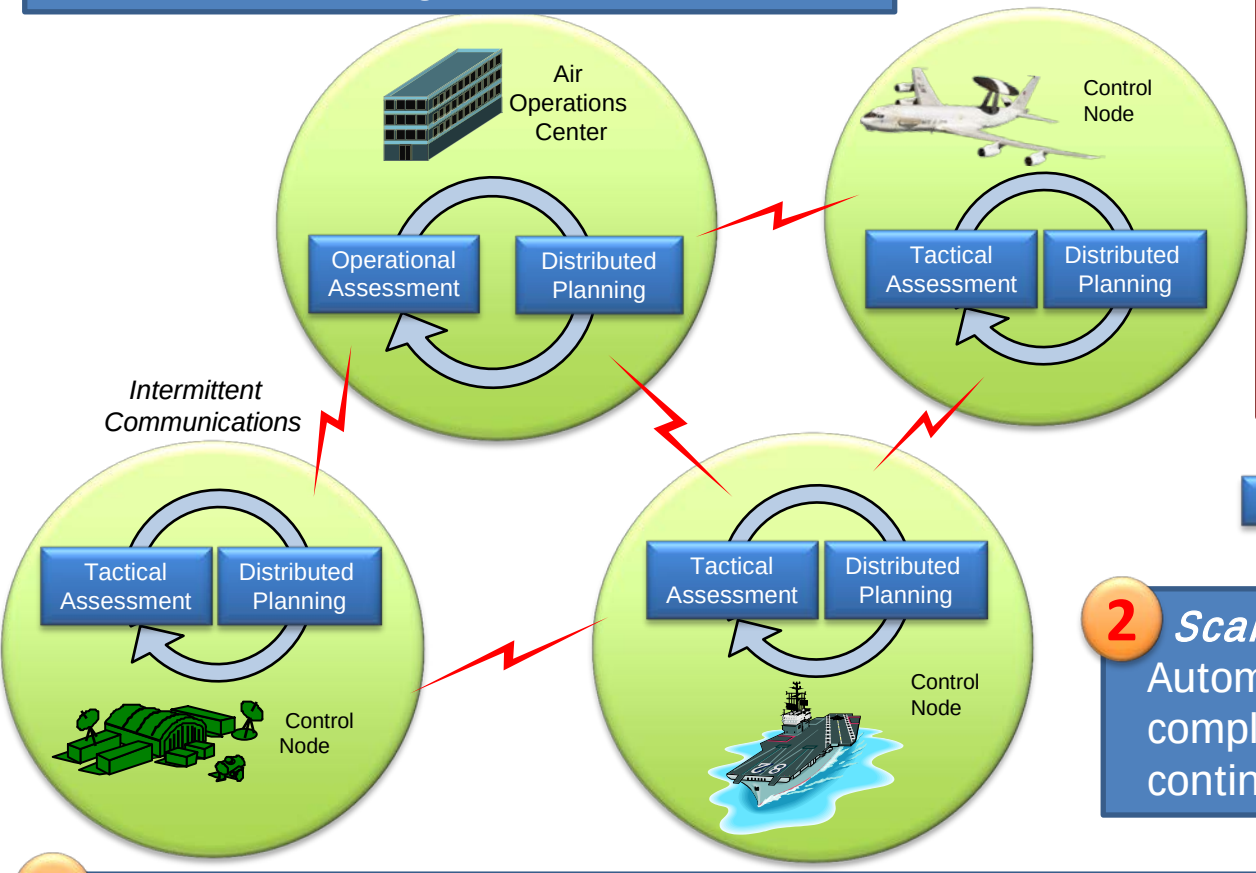
Human-centered tools for decentralized control of operations - A leap-ahead in resilience, responsiveness, and effectiveness



The RSPACE Solution – Helping Distributed Operators Control the Air Campaign

1 *Distributed Coordination*

Decentralize planning – enable agile coordination throughout the C2 network



- 10x + reduction in manning
- 10x + reduction in time
- Continuous operations in the face of uncertain C2 architecture
- Real-time adaptability of plans
- Integrate strike, ISR, and EW planning

= RSPACE Product (software)

2 *Scalable Automatic Planning*

Automation support to plan 1000s of complex interdependent missions – continuous updates to a "living plan"

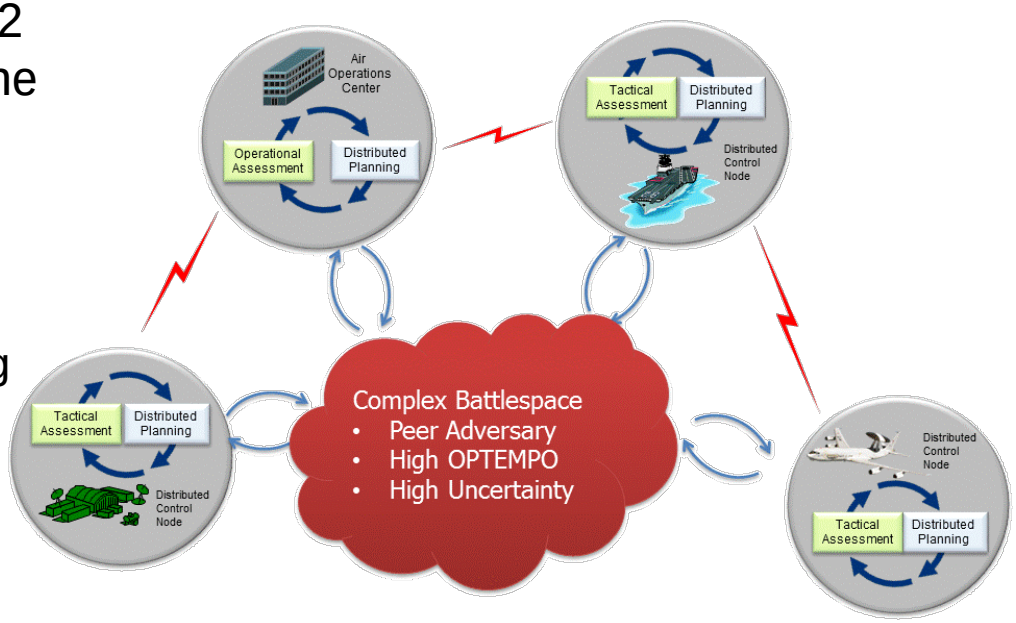
3 *Human-Centered Automation*

User-adjustable level of automation - inject guidance and constraints during planning process

Challenge: Distributed Coordination

Plans to be produced by distributed C2 cells - must degrade gracefully with the loss of communications.

- Available Technology
  - Auction mechanisms
  - Problem decomposition / decoupling
  - Multi-agent systems



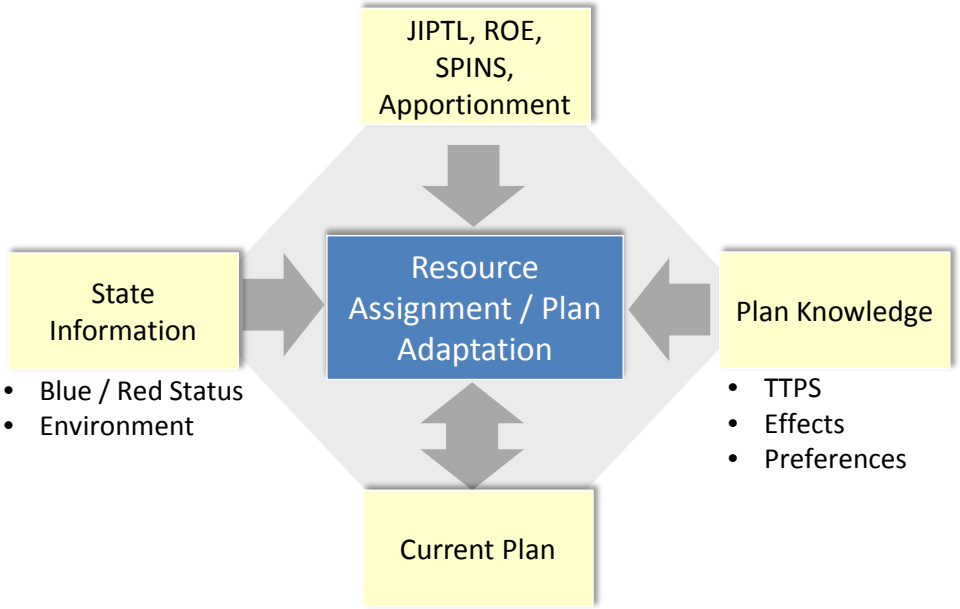
- RSPACE
  - Resilient during extended periods of low bandwidth / high latency communications
  - Intelligent, network-aware messaging supports access to expertise. Send queries, not data
  - Arbitrate resource contention with respect to commander's guidance

Intelligent service requests can enable distributed coordination in communications-challenged environments

Challenge: Scalable Automated Planning

Automation support for small staffs planning and managing operations for as many as 1,000 different platforms.

- Available Technology
  - Heuristic search
  - Approximate dynamic programming
  - (Distributed) Constraint optimization
- RSPACE
  - Distributed algorithms scaled to thousands of sorties
  - Integrate planning for strike, ISR and spectrum
  - Living plan to support integrated planning / replanning

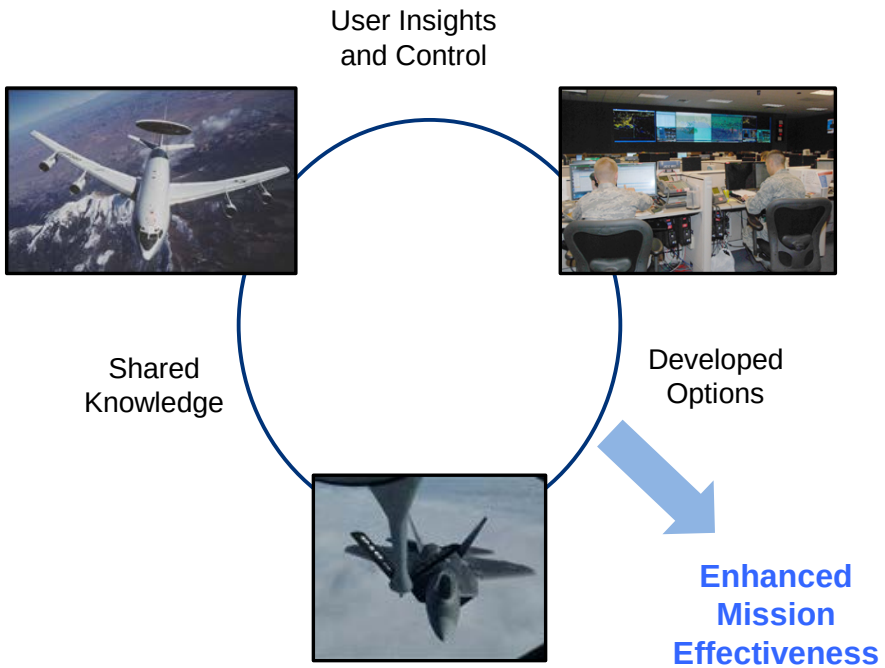


Support small, distributed staffs by automating as much of the low-level problem solving and bookkeeping as possible

Challenge: Human-centered Automation

•Planners will not accept automation if they cannot retain the transparency and control afforded by the current largely-manual processes.

- Available Technology
  - Constraint visualization for mixed-initiative systems
  - “Model-lite” techniques to plan with incomplete / incorrect domain models
  - Work-centered design and cognitive task analysis
- RSPACE
  - Enable users to retain the insight and control afforded by current processes
  - Provide the ability to create, access, modify



Combine the insights and creativity of users with the ability of computers to quickly explore options and track details

Course of Action Analysis, Execution Monitoring, and Assessment

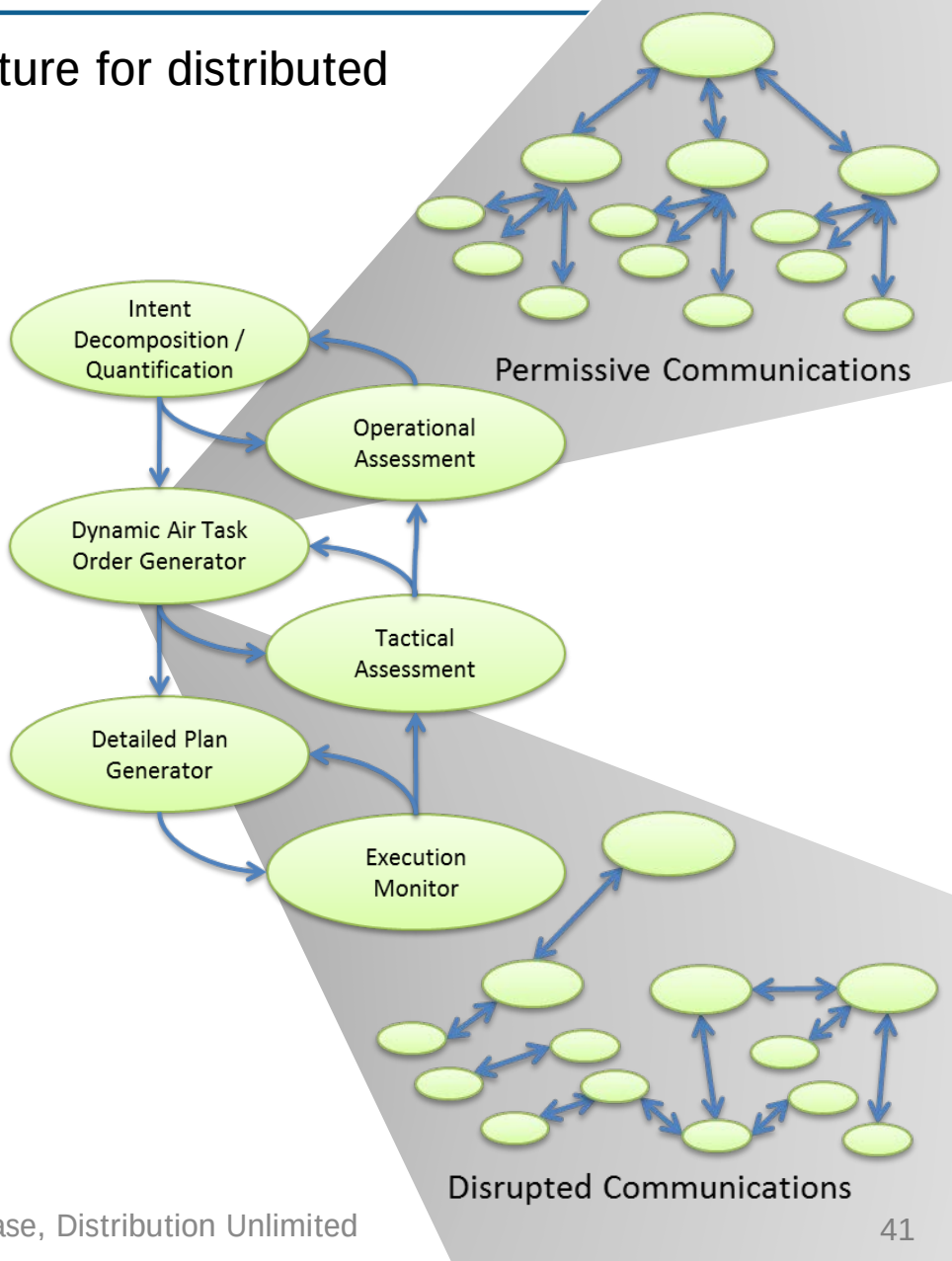
- Assess progress towards achieving commander's intent before, during, and after execution
- Technology Challenges
  - COA Analysis: Tools for visualizing and evaluating plans and in terms of intent
  - Execution Monitoring: Track plan milestones
  - Execution Assessment: Assessment of progress towards achieving commander's intent
  - At all levels, understand dependencies and analyze implications – cascading effects
- Relevant Technology
  - Model-based matching of indicators for courses of action
  - Diagramming / graph-based techniques combine indicators for assessment
  - Modeling and simulation; adversary modeling

Are we doing things right? Are we doing the right things?

Software Architecture to Enable Distributed Control

Maintainable and resilient software architecture for distributed control

- Technology Challenges
  - Flexible applications adapt to environment and local authority and mission
  - Common runtime environment despite different computational environments
  - Applications loosely tied to infrastructure services
- Leverage Best Software Practices
  - Run-time software environment with common core services - leverage commercial tools where possible
  - Local run-time environments (“system in a box”) allowing local development and testing in the system context
  - Frequent integration events to drive development based on system-level performance

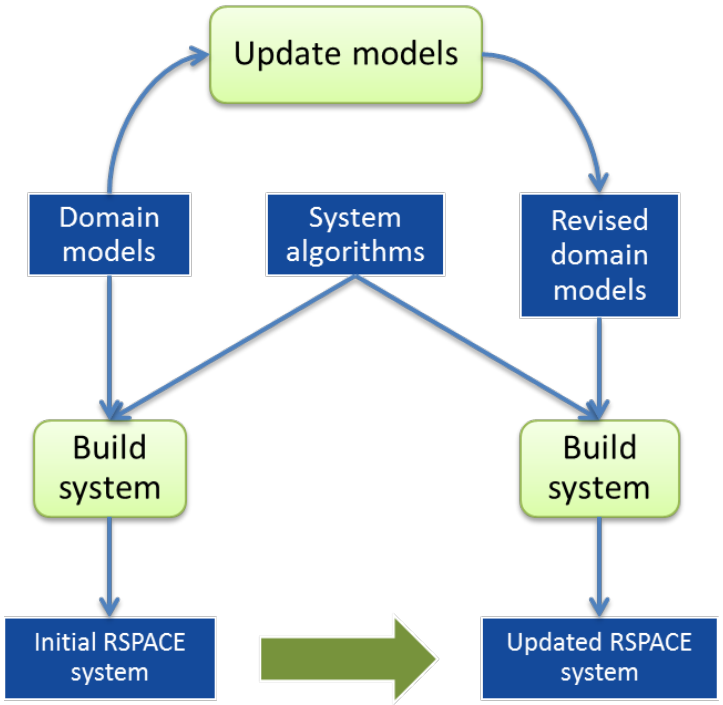


RSPACE Applications Should Be Flexible And Readily Adaptable

- Low-cost adaptation of software to align with changes in CONOPS, platforms, capabilities, and tactics

- Technology Challenges
  - Run-time environments that allow easy incorporation of system models
  - Tools for rapid model authoring / update, verification, and validation by end users
  - Strong constraints on model structure and content - key to making authoring and validation tractable for end users

- Relevant Technology
  - Tools & architectures for model-based design (software systems, manufacturing)
  - Semantic web tools for knowledge-base authoring



Reduce costs and delays incurred evolving to new systems / tactics

Anticipated Impacts

	Today	With RSPACE
C2 Architecture Resilience	Centralized C2 at the Air Operations Center (AOC) – reliant on robust communications	Distributed throughout C2 enterprise – resilient in the face of dropped links and nodes
Staffing	~1000 Staff @ AOC	10s of operators at each C2 node
Planning Timeline	• ~30 hours to generate a 24-hour plan • Occasional dynamic targeting – manual selection of options	• ~3 Hours (operator-in-the-loop) to generate 24-hour plan • Continuously update "living plan" based on real-time assessments • Minutes to generate dynamic replan
Synchronization	Stove-piped process – e.g., ISR planned independently from strike	Fully integrated planning process - simultaneously planning all domains (ISR, Strike, EW)

Transition

- **RSPACE Products:** Planning and assessment software applications supporting both current centralized and future distributed control CONOPS

- **Transition Opportunity**
  - AN/USQ-163 Falconer Air and Space Operations Center (AOC) Program of Record
  - PACAF and ACC exploring the *Distributed Control Node (DCN)* concept
    - ACC and PACAF looking to DARPA (through informal partnership) to develop and prototype mission applications in support of DCN concept
    - PACAF A3/6 developing CONOPS and doing experimentation

- **Strategy:** Operational engagement and pull from day one
  - Continue working closely with ACC/A5, PACAF, and 505th CCW to shape the effort and conduct joint experimentation
  - Recruit operators for experimentation
  - Develop applications with the goal of coevolving CONOPS and technology

Program Structure

Program Tasks

- **Task 1: Planning Technology Development**
  - Human-accessible distributed planning and assessment capabilities
  - Multiple awards expected
  - Performers encouraged to propose solutions that provide the functionality identified in the BAA
  - Eventually integrated into a single demonstration prototype using selected capabilities
- **Task 2: Distributed Software Infrastructure and System Integration**
  - Software architecture and integration
  - Transition support
  - Two awards, down-select to a single performer
- **Evaluation Support**
  - Government team to lead evaluation and demonstration efforts, manage group-level system engineering effort

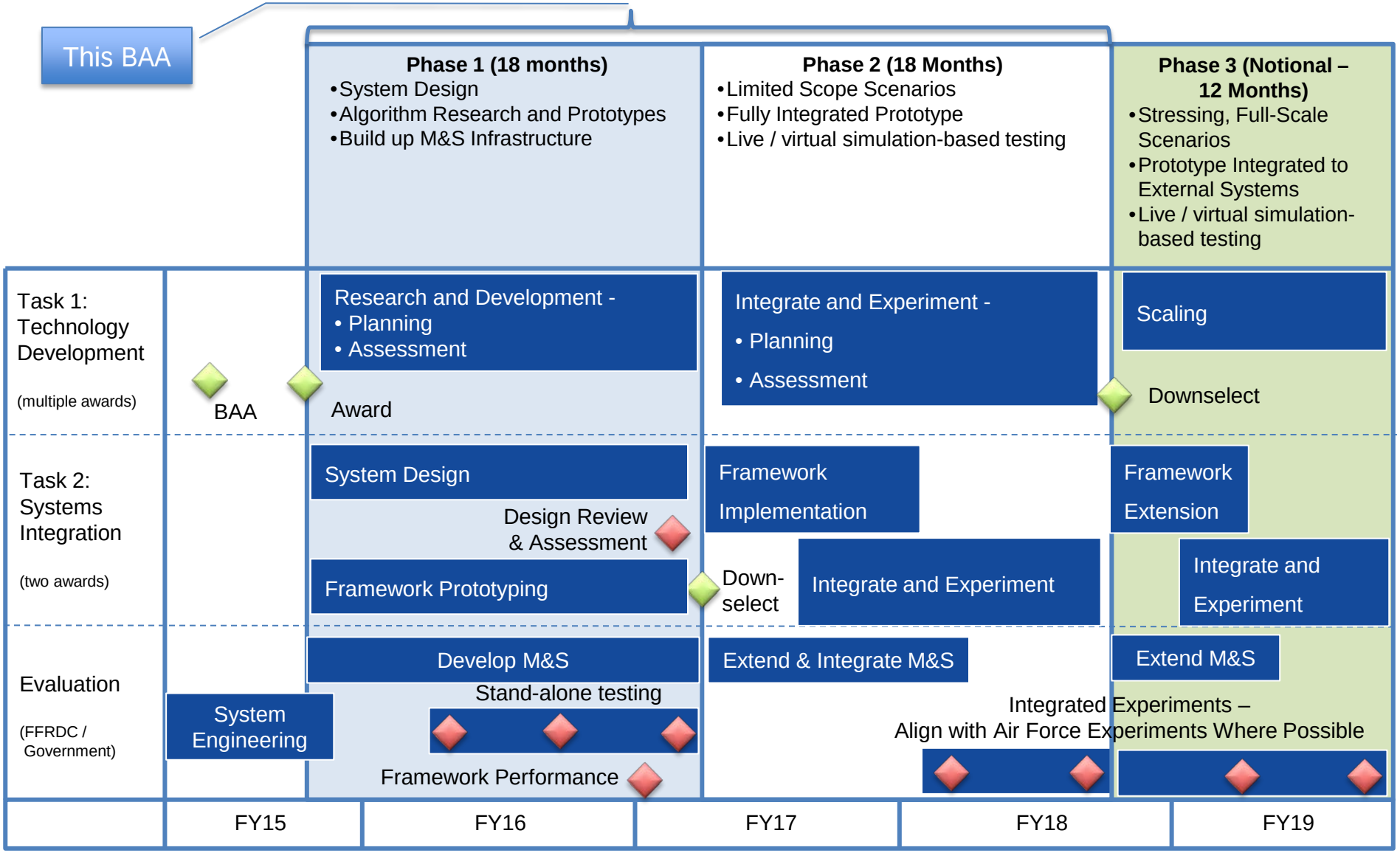
Program Phases

- **Phase 0 (Pre-Award)** Groundwork
  - Government team system engineering – functional architecture
- **Phase 1 (18 months)** Iterative Problem Specification
  - Algorithmic development and refinement
  - Emphasis on human factors
  - Iterative development of M&S test and development.
  - Framework design and interface definitions – collaborative
  - Down-select to one integrator
- **Phase 2 (18 months)** Integration and Evaluation
  - Functional prototype deployed and evaluated in a realistic Air Force context
  - Two major evaluation events. 100s of assets, three or four C2 nodes
  - Task 1 component-level assessments
  - Down-select to final Task 1 capabilities

NOT covered in the BAA

- **Phase 3 (Notional - 12 months)** Demonstration in a Realistic Environment
  - Two demonstrations planned - ~1000 assets across 5-10 distributed C2 staffs

Plan


This BAA
Phase 1 (18 months)
•System Design
•Algorithm Research and Prototypes
•Build up M&S Infrastructure
Phase 2 (18 Months)
•Limited Scope Scenarios
•Fully Integrated Prototype
•Live / virtual simulation-based testing
Phase 3 (Notional – 12 Months)
•Stressing, Full-Scale Scenarios
•Prototype Integrated to External Systems
•Live / virtual simulation-based testing
Task 1: Technology Development
(multiple awards)
Research and Development -
• Planning
• Assessment
Integrate and Experiment -
• Planning
• Assessment
Scaling
BAA
Award
Downselect
Task 2: Systems Integration
(two awards)
System Design
Framework Implementation
Framework Extension
Design Review & Assessment
Framework Prototyping
Down-select
Integrate and Experiment
Integrate and Experiment
Evaluation
(FFRDC / Government)
Develop M&S
Extend & Integrate M&S
Extend M&S
Stand-alone testing
System Engineering
Integrated Experiments –
Align with Air Force Experiments Where Possible
Framework Performance
FY15
FY16
FY17
FY18
FY19

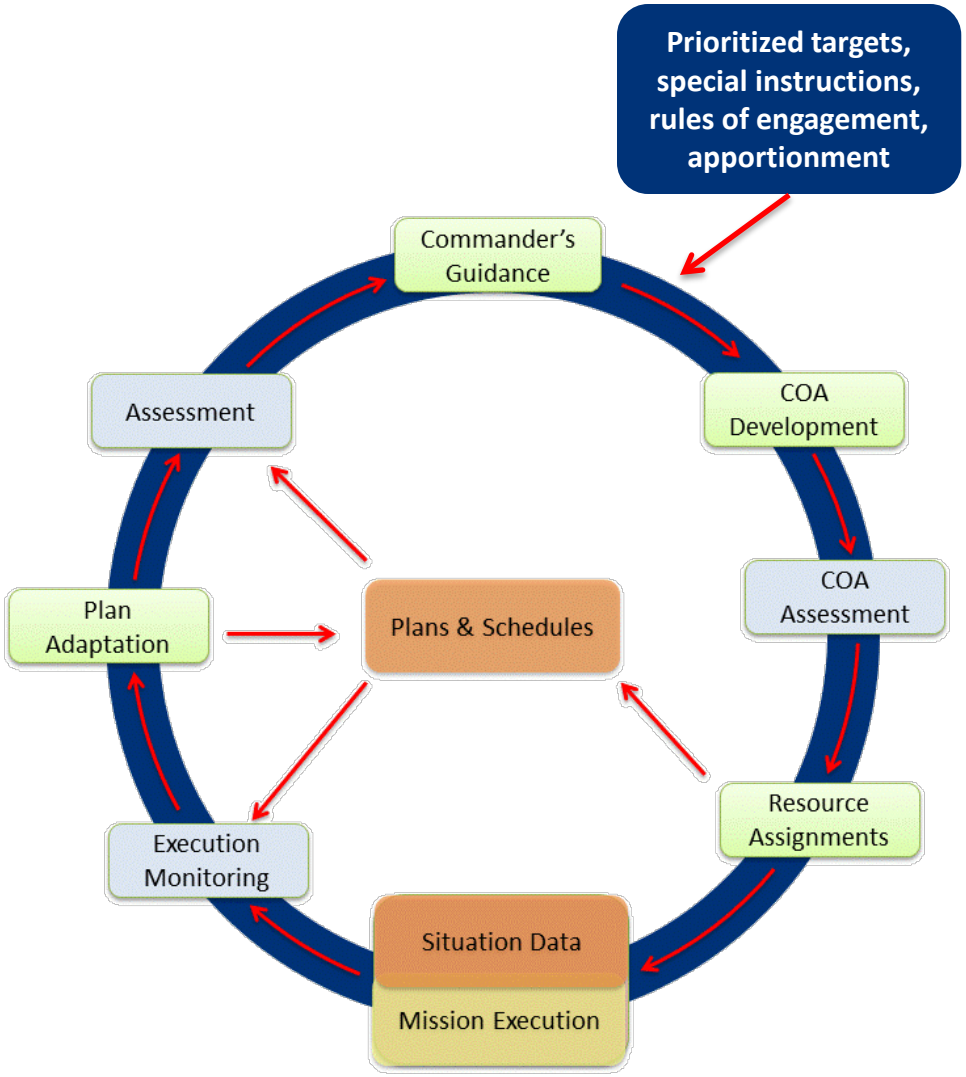
Task 1 Overview

- Planning and Assessment technologies
  - Proposed capabilities need to support distribution across C2 nodes (*exception:* Commander's Guidance)
  - All proposals should address usability / human factors
  - Proposals should identify candidate metrics and evaluation requirements
- *Functional requirements* - Performers should bid the functionality for which their technology is most appropriate

- Multiple awards anticipated, overlapping capabilities expected
  - Proposals should assist reviewers in assessing the extent to which multi-function solutions can be decoupled

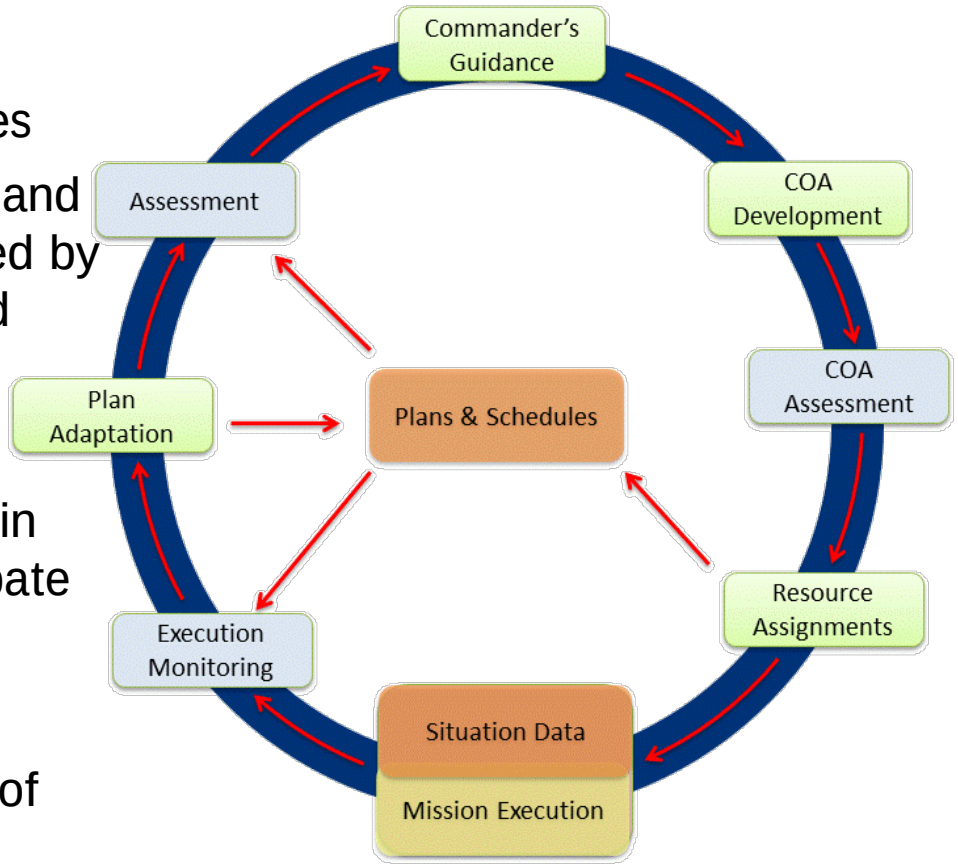
Task 1 – Functional Breakdown (1 of 2)

- Commander's Guidance
  - Interface that will allow a commander to provide guidance and constrain solutions
- Course of Action Development
  - Assist human planners in the collaborative development of mission plans
  - Provide transparency into plans being developed and enable planners to impose constraints on solutions
- Course of Action Assessment
  - Enable planners to assess COA alternatives in terms of commander's intent



Task 1 – Functional Breakdown (2 of 2)

- Resource Assignment / Plan Adaptation
  - Core plan automation capabilities
  - Must be addressed together, though potentially with different technologies
  - Must propose a plan representation and develop plan editors that can be used by subject matter experts to create and refine representations
- Execution Monitoring
  - Help users track the status of plans in execution so they are able to anticipate and identify necessary changes
- Execution Assessment
  - Focus upon determining the effects of kinetic operations and short-term adversarial responses to assist with future planning



Task 2 Overview

- Key Tasks
  - System Engineering
  - Software Framework
  - System Integration
- System Engineering
  - Informed by program-wide working groups
  - Develop requirements and design (architecture, interfaces, etc.)
- Software Framework
  - Maximize COTS / GOTS capabilities and open messaging standards
  - Standards should include a plan representation capability that will support Task 1 developers
  - Address multi-level security requirements and include state-of-the-art cyber-defense

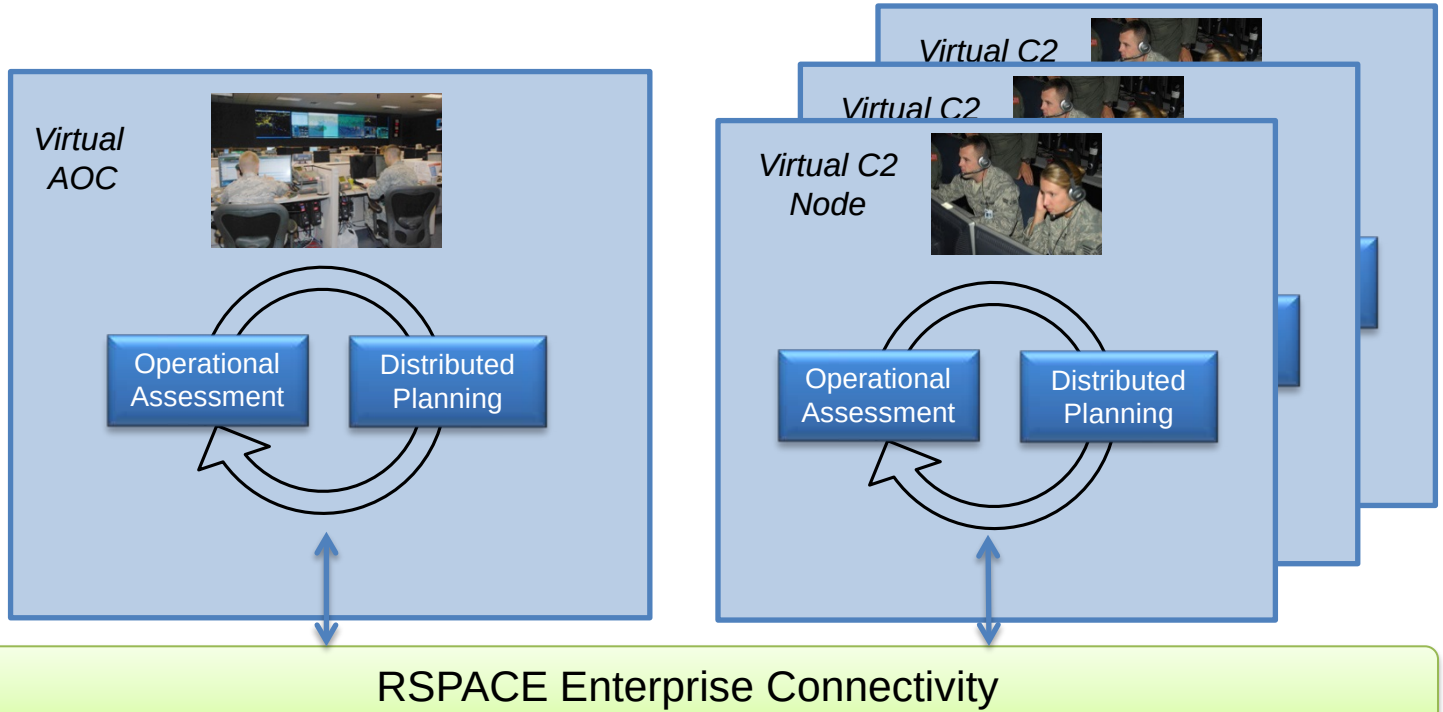
Task 2 Overview - Continued

- System Integration
  - Proposals should identify a flexible, rigorous (agile) development process to support the integration of Task 1 capabilities
  - Expected to provide a Software Integration Lab beginning in Phase 2
  - Transition strategy should emphasize military standards, connectivity with existing AOC systems

- Multiple Awards Anticipated
  - Downselect to a single integrator in Phase 2
  - Downselect could be a combination of multiple Phase 1 awardees

Large-Scale Human-In-The-Loop Experimentation Driven By Real Operators and Simulation

In Discussions With 505th Test and Evaluation Group to Host Experiments



Interactions with Modeling and Simulation

- M&S environment
  - Based on government-owned AWSIM (Air Warfare Simulator) – maintained by 505th CCW
  - May be extended by government-led team for increased dynamics and decreased reliance on human-in-the-loop
- RSPACE interface to M&S environment
  - Built and managed by government-led team (for **all phases** of program)
  - Based on operationally-relevant message set (ATO, MISREPS, etc.)
  - Message set and interface dynamics informed by program-wide (all Task 1 and Task 2 performers) working groups in Phase 1
- Phase 1
  - Evolve M&S capability and develop interfaces (government-led)
  - Task 1 – Direct integration (stand-alone components) with M&S for Resource Assignment, Plan Adaptation, and Execution Monitoring; Integration managed by government team
  - Task 2 – No direct interaction with M&S environment; Help shape interfaces through working group participation
- Phases 2
  - Selected Task 2 performer work with government team for M&S integration of RSPACE system (informed by Phase 1 interfaces)
  - Task 1 performers work with Task 2 performers to integrate into RSPACE framework – no direct interaction with government team

Metrics to Measure Program Progress and Success

Area	Metric	Measure
Planning	Plan Quality	Infeasibility Rate: % of missions with insufficient resources (e.g., fuel) or otherwise not executable
		Failure Rate: % of missions that did not achieve intent (simulated)
	Workload	Reduction in average # of operator hours per mission
Dynamic Targeting	Kill Chain Success Rate	Failure Rate: % of dynamic targets not successfully prosecuted
	Base Plan Disruption	Number (value) of planned missions / tasks (incl. existing dynamic targets) dropped in order to service dynamic targets
	Workload	Reduction in average # of operator hours per mission (new or updated)
Assessment	Tactical Estimation Error	# of mission MOPs w/ significant difference between tactical assessment estimation and ground truth (via simulation)
	Operational Estimation Error	# of objective/task MOEs w/ significant difference between operational assessment estimation and ground truth

MOP = Measure of Performance
MOE = Measure of Effectiveness

Evaluation

- Evaluation managed by government team, conducted in government testbed

- Phase 1
  - Task 1 – stand-alone capability evaluations in M&S environment
  - Task 2 – framework prototype capability demonstrations, system design
  - All performers evaluated based on their participation in working groups
- Phases 2
  - Task 1 – component performance in integrated system (in M&S environment)
  - Task 2 – integrated system ability to incorporate new capabilities, handle MLS, cyber defense, integrate with legacy systems, etc.

Submission Highlights

- Abstracts
  - DARPA will be accepting 4-page abstracts for Task 1
  - Opportunity to receive feedback in advance of committing to full proposal
- Proposers May Bid on Both Task 1 and Task 2
  - Must submit separate proposals
  - Task 1 proposals may address multiple functional areas.
- Evaluation Criteria
  - Overall Scientific and Technical Merit
  - Potential Contribution and Relevance to the DARPA Mission
  - Cost Realism

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM

RSPACE Proposer's Day Agenda

Start	End	Topic	Presenter
13:00	13:05	Security	Stanley Smith, DARPA SID
13:05	13:10	Welcome	Craig Lawrence, DARPA PM
13:10	13:25	DARPA STO Overview	Craig Lawrence, DARPA PM
13:25	13:45	C2 of Air Operations	Col. Richard “Scotty” Wright
13:45	14:10	Distributed Control	Lt. Col. Jeffrey York, ACC/A5
14:10	15:00	RSPACE Concept	Craig Lawrence, DARPA PM
15:00	15:30	Break	
15:30	16:25	Q&A Session	Craig Lawrence, DARPA PM
16:25	16:30	Closing Remarks	Craig Lawrence, DARPA PM